Managing in smart cities – A network approach

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Abstract

Purpose: The smart city idea relies on multiple stakeholders collaborating locally. Smart cities might produce considerable changes to companies' ways of acting. This paper adopts a network approach to discuss how companies would manage in smart cities, while also actively shape such cities. The underlying question relates to whether radical new ways of organising from a societal point of view, affect the management of companies.

Design/methodology/approach: The paper is conceptual, while providing examples based on research and documents on smart cities.

Findings: The paper points to how interaction among companies (and other organisations) would increasingly be determined by geographical location; how companies will grasp opportunities related to creating and offering solutions in line with smart city objectives; and how the ways business and interactions are formed, along with their new foci will impact and reshape smart city initiatives. But while companies would increasingly confront, create, and coerce, the network would still limit the developments to smart cities.

Originality/value: Research on smart cities has focused on the policy and societal levels, while so far there is a lack of details on how companies will act as part of such initiatives. The paper contributes to previous research through connecting smart city descriptions to research on companies in networks.

Keywords: Future; Management; Network; Smart city; Technology.

Article Classification: Conceptual paper.

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1. Introduction

To meet the criticism of global production systems (Bonilla, 2014), and trends of urbanisation (Edwards, 2013), *smart cities* has appeared as a concept to demonstrate new ways of conducting businesses and organising city life. A smart city is: "*a city seeking to address public issues via information and communication technology-based solutions on the basis of a multiple stakeholder, municipal based partnership"* (Manville et al., 2014). The smart city idea focuses on production and consumption moving from global to local; manufacturing from competitive to collaborative; and business from a shareholder to a multiple-stakeholder point of view (Herrschel, 2013, Saint, 2014, van der Graaf and Veeckman, 2014). Technological developments including additive manufacturing, digitalisation, 3D printing, and fabrication technologies, enable production to be increasingly local, while social pressure increases for sustainable solutions (Katz and Bradley, 2013). The smart city idea could suggest to radically change the way companies act and interact.

In this paper, smart cities function as an example to discuss whether and how companies' way of interacting actually changes based on radical societal changes. In doing so, the paper adopts an IMP network approach (e.g., Ford and Håkansson, 2006) to discuss how companies would manage in smart cities, while also actively shape such cities. The network approach, and specifically its way of reflecting on the management in networks (Ford and McDowell, 1999, Håkansson and Ford, 2002, Ritter et al., 2004), guide the discussion.

The paper contributes to previous research through connecting smart city descriptions to research on managing in networks. Previous literature on smart cities has focused on the policy and societal level (e.g., Herrschel, 2013, Angelidou, 2014, Manville et al., 2014, Ben

Letaifa, 2015), and the introduction of the IMP network approach to that type of literature reflects a new theoretical perspective on smart cities, while helping to grasp companies' perspective and contribution to smart city research. Through describing how smart cities become shaped by the organisational actions of firms, we theoretically integrate together smart city initiatives with IMP ideas at the company level, in a way different to seeing smart cities simply on the societal level. The focus on smart cities as an empirical example helps to discuss changes to the management in networks based on societal level alterations, and there contributes to discussions on how companies manage in networks, and whether and how such management potentially changes in the future.

The remainder of the paper is structured as follows: The next section presents a more detailed description on smart cities. To exemplify the smart city idea, we collect descriptions from previous research and other output collected from city authorities and corporate institutions. The examples presented intend to introduce the meaning of smart cities and explore the reasons for and performance of smart city initiatives. We then describe ideas on managing in networks based on the IMP network approach. Thereafter, we link together these ideas. We end the paper with discussing the mutual implications for the integration of the IMP network approach with smart cities, and outlines topics for further research, along with concluding whether radical new ideas on a societal level may or not change how companies manage in networks.

2. Smart cities

2.1 Definition and background

As pointed out in the introduction, the smart city idea links to some various development phenomena in today's society: the technological evolution that enables local manufacturing

through 3D-printing and similar; the increased pressure for sustainable solutions and decreased emission; and also the urbanisation of people. Katz and Bradley (2013) refer to the beginnings of a "*Metropolitan Revolution*" which will increase "*social pressure*" from different stakeholders and institutions (civic authorities, councils, public bodies) for firms to create more sustainable solutions. The scale and speed of urbanisation has meant that many cities have grown beyond their historic boundaries, and have sprawled to form larger metropolitan areas. Rifkin (2014) suggest that parties increasingly take to produce their own solutions locally, individually or collaboratively: "*a smart urban world where individuals and communities will generate their own free energy, produce and share things they need and build their city economies on collaboration not competition*". Collaborations of different sorts and a stakeholder perspective partly follow from these developments, not the least connected to the societal pressure for sustainability. But while these development indicate a direction and move from competitive to collaborative, from global to local, and from shareholder valuations to stakeholder concern and involvement, literature on smart cities still gives the smart city phenomenon many different understandings.

First of all, smart cities may refer to cities as geographical locations, or as municipal administrations. The former then indicates how the researcher's focus relies on the geographical delimitation that a city constitutes (Katz and Bradley, 2013), while the latter points to how smart cities may be controlled and managed by city administrations. The "smartness" of smart cities has also come to capture different phenomena and meanings. Giffinger and Suitner (2015) point to how a smart city incorporates at least one of the following dimensions: smart economy (e.g., innovation, entrepreneurship, productivity); smart mobility (e.g., accessibility, sustainable transport system); smart environment (e.g., pollution, sustainable resource management); smart people (e.g., level of qualification,

creativity and flexibility); smart living (e.g., quality of life); and smart governance (e.g., public and social services, transparent governance). Balta-Ozkan, Amerighi and Boteler (2014) add smart homes to this description. The various dimensions indicate different societal functions (Ben Letaifa, 2015), including health, energy, water, waste, communications, buildings, and transport; but also their potential integration. Additionally, items connected to smart cities could either be seen as their means or end (Giffinger and Suitner, 2015); smart city initiatives may be enabled through information technology, or the technology is in itself one factor that characterises the smart city, according to literature.

The "smartness" hence captures various phenomena as described by Giffinger and Suitner (2015), but furthermore: its meaning has developed from only concerning sustainability issues. As referenced by RPA (2014), the smart city concept has displaced "the sustainable city" as the choice of word to denote ICT-led urban innovation and new modes of governance and urban citizenship, and based on how some observers have pointed out that smartness as a term is more politically neutral than sustainability. Herrschel (2013) points to how the smartness of smart cities has come to include: "*innovativeness, participation, collaboration and co-ordination*", thus pointing to how it stretches beyond pure sustainable concerns.

But while covering many different phenomena, the issues of local production, sustainable solutions, and collaboration come across as central in most descriptions on smart cities. Most descriptions further refer to the technological development as an antecedent for smart cities; and sustainability as a pressure for new ideas (cf. Deakin, 2012, Bourmpos et al., 2014, Debnath et al., 2014, Doran and Daniel, 2014).

As for *technology*, and in addition to local production systems, smart cities are associated with sensor or household data. Big data, that is large pools of unstructured data that can be stored, managed, and analysed (Manyika et al., 2011), is seen as central to smart cities, in how large sets of data would inform about activities of different city actors (Dirks et al., 2010). In the view of smart cities as administrations, the integration of city systems is an important sub-theme of city government-led smart city visions and plans, which though seems to suggest that data is pooled rather than integrated, and that analyses need to establish interaction patterns rather than be based on how actors actually interact. The big data analyses are referred to as what bring meaning to the data through interlinking it, while it in its capturing is unstructured and unconnected.

The *sustainability* dimension is, in addition to local production much associated with logistics/transport aspects. Such aspects point to how transportation would need to be reorganised so as to deal with carbon footprint. The logistic aspects could be seen as a move from individual firms optimising their transportations, over collaborative, or system level analyses of flows (McKinnon, 2008, Öberg et al., 2012), to redrawing the landscape and focus on local production, and thereby foremost short-distance transportations. Ideas are radical changes driven by, or leading to local production, thus rather going from centralised transport solutions (Kohn, 2008, McKinnon, 2008) to distributed, than reverse. City manufacturing includes plants located near to the centres of productive talent, and future technology contributing to a manufacturing revival characterised by: re-shoring and clusters of co-created and customised production activity including, for instance, fast fashion and city textile networks based on customised garment production designed and co-created with consumers.

2.2 Some illustrations on smart cities

Various cities have claimed to introduced, or be working on, smart city initiatives (Manville et al., 2014); including: projects in Berlin and Cologne that apply smart city ideas; a long-term urban strategy in Lyon, and an urban research program in Paris as part of a government program to create smart communities; a federal energy department project defined to be part of smart cities in Switzerland; a UK program started to help cities develop smart technology and foster collaborative consumption; and a new urban innovation centre in Zaragoza. A shared feature of these examples is the role of the city administration to create smart city initiatives. Thus, the initiatives are governmentally controlled or initiated and the smart city concept refers to a city administration rather than geographical delimitations of urban areas. Making new governance arrangements efficient and effective is considered to be key to the viability and success of other future city initiatives.

With the focus on city administrations, and in the light of growing city areas and urbanisation, follows a wide range of metropolitan governance innovations. These innovations include consolidation of certain specific powers, such as planning powers (e.g., New York), partnerships between neighbouring municipalities (e.g., Zurich, Amsterdam, Gdansk-Gdynia-Sopot in Poland), and agreements with national/state governments and/or the private sector (e.g., the UK's 'City Deals'). Integration of city systems is another important sub-theme of city government-led smart city visions and plans. The Dubai SmartCity strategic plan is based on three central ideas: communication, integration, and cooperation. It is the city government's goal that all city services and facilities should be made available on smartphones, and that all city databases should be integrated and made publicly available via "My Window to Dubai"; a live, online, real-time broadcast of the changing data. GEYSER ("Green Networked Data Centres as Energy Prosumers in Smart City Environments), an international consortium of ten European organisations developing the intelligent integration

of energy efficient networked urban data centres, partly powered by renewable energy, aims to trade off energy (i.e., power and/or heat) exchanges with smart city infrastructures against workload exchanges with other data centres in its network.

Further examples denote similar understandings of smart cities as controlled or planned by city administrations: in Stockholm the local authority publishes data and empowers the own government or third parties to take action from it. Stockholm's approach to smart city investment is claimed to be citizen centric though, and emerged from the work of creating e-government services. The city has funded a large fibre-optic broadband network through Stokab, a city-owned company, and sees itself as a test-bed for new technology. Kista Science City in Stockholm acts as a focal point for technology innovation and economic development around smart city technologies. Vienna take a holistic view of the smart city, implementing initiative to cover everything from energy, infrastructure, green spaces, and mobility, to all aspects of urban life and development. Other cities focus on a very specific element of smartness but aim for geographical coverage in a city. For example, Yokohama in Japan is pioneering a specific project based on the installation of energy management systems across the city. In Skellefteå, Sweden, Skellefte Kraft (power company), SQS and Explizit (software specialists) work with city planners to implement sensors to measure, monitor and communicate and more efficiently allocate resources such as electricity, water, traffic, and waste. In Malaga, a consortium of eleven companies spearheaded by Endesa, are focusing on renewable energy, smart metering, smart distribution, and electric vehicle projects. These examples seem to suggest the connection between smart cities and sustainability.

As for other actors (in addition to city administrations) engaging with smart city initiatives, the Maker Cities websites (http://www.makercities.net/) includes many citizen suggestions

relating to technology, networking and integration of city systems. Example suggestions include: “Smart Alarms” that use sensors to understand citizen daily routines, installations of super-fast broadband and entire city Wi-Fi areas. There are however some indications of a disconnect between smart city plans drawn up by cities, firms, and universities, and the expectations of ordinary citizens (Graham et al., 2014).

Taken together, smart city initiatives may mean some different things, which also the literature illustrates, but suggest involving city development to various extents. The smart city is in its early practices defined by *municipal administrations*, and much of the work suggests to be formed by governmental forces, rather than through the initiatives of companies or citizens. *Technology* functions as enabling forces, where early practical examples focus less on local production, and more on how cities may help to collect data on its citizen to direct governmental planning. Additionally, much of the technology is devoted at solving *sustainability* issues, and the practical area of implementation is frequently that of energy, logistics, and related.

3. Managing in networks

3.1 The difficulties of managing in networks

According to the IMP network approach, companies (buyers and sellers in the market) are interdependent (Håkansson and Snehota, 1995). This follows from how resources are scarce, but also developed in interaction among parties (Gadde, 2004). Adjustments to single actors’ needs follow from how these actors represent substantial revenues, or are based on knowledge expertise or unique resources by the other actor.

Since one company is linked to several other parties, interdependence does not only happen between a buyer and a seller, but in complex patterns of companies: a customer has several suppliers; a supplier another supplier; a customer a collaboration partner, and so forth (Anderson et al., 1994). This all means that a decision taken related to one relationship may have effects also for other relationships, such as in the example of choosing to buy from one supplier (and thereby not from another supplier), or in how the exchange with the first supplier affects also that supplier's suppliers and decisions vis-á-vis the supplier's other customers. This is the network of relationships; interconnected relationships and their impact on one another (e.g., Smith and Laage-Hellman, 1992).

The interconnectivity among actors and their relationships does not only mean that business decisions result in more or less buying or selling for other actors. It also means that companies may react in unforeseeable ways to decisions taken (Havila and Salmi, 2000), and in how different exchanges and decisions occur in parallel: the context (represented by the other actors) is constantly changing. Network dynamics refers to such ever-shifting changes on relationship and network levels (Gadde and Mattsson, 1987, Freytag and Ritter, 2005). And such dynamics, in addition to how companies do not control all resources they actually need, makes the management of networks problematic. A decision taken by a company will not (necessarily) be realised based on reactions, and based on how the context has changed in the meanwhile. And, the context of a company consists of directly or indirectly connected organisations, thus indicating how actions and reactions are reflected through parties rather than faceless events coming from outside.

Literature has pointed to how strategising in networks is an impossible task (Baraldi et al., 2007, Waluszewski et al., 2009), then thinking about strategy as a plan (cf. Mintzberg, 1973),

or related. Researchers also mean that networks cannot be managed; companies will need to learn how to manage in them instead (Håkansson and Ford, 2002). Seen that way, the management is wider defined than the strategising as a plan; it includes taking other parties into account, pre-thinking how they might react, calculate for changes, and/or share strategies on an interaction level (Chou et al., 2014). But while literature has been frequent to denote how the context is changing (Freytag and Ritter, 2005), for the most part, this refers to incremental changes (Havila and Salmi, 2000) and where literature does not discuss radical societal changes to networks and the management in them.

3.2 The 6C model of networking

As a means to guide the further discussion on companies' managing in smart cities, and whether such potentially radical societal level changes as smart city initiatives may change the management of firms, the 6C model (Ford et al., 2003), linked to the three paradoxes developed in Håkansson and Ford (2002) is taken as point of departure.

Håkansson and Ford (2002) describe how the network provides a company with its opportunities, while also constraining its activities. This is so based on how the network contains valuable resources, while the resources in the network also delimit what the company can do. Håkansson and Ford (2002) further refer to how a company influences yet is influenced by the network, and how the company's strategising has resulting effects for what relationships are created, while these relationships in turn decide the outcome of the company. Lastly, Håkansson and Ford (2002) describe how companies may try to control the network, while not being able to do so and rather being "controlled" by the network. All in all, the paradoxes outlined in Håkansson and Ford (2002) point to the difficulties of managing in networks, and the interdependence that exists between a company and the network.

To though give an idea on how companies would handle the difficulties of managing in networks, Ford et al. (2003) discuss how companies manage in a network context through *confronting* or *conforming* in business relationships; *creating* or *consolidating* so as to maintain or achieve new network positions; and *coercing* or *conceding* to the network and those capabilities present there. Conforming and confronting relate to decisions on which business relationships the company should adjust to, and which should be challenged. The assessment of the various relationships is important in this regard, as is the analysis of the long-term effects of both adjusting to, and challenging the particular relationship. The confrontation may have as end to terminate the relationship, but could also expect to raise issues of concern in the relationship. Expectedly, reactions are stronger if the company confronts an interaction partner (Chou et al., 2014), than conforms with it, also meaning that the company can choose a path less risky, but which also means that it cannot actually change its circumstances that easily. The consolidating and creating refer to the handling of present relationships and the creation of new ones. Through establishing new relationships, the company's network position might change (while not fully decided by the company), while the continuation of present relationships suggest to keep more of the present position of the firm. However, the position may also change based on changes introduced by business partners, thus indicating the importance of analysing their activities as suggested in the conform/confront dimension. Coercing and conceding, lastly, describe how the company assesses the overall network to decide whether it should adjust to present capabilities or try to make network parties' adjust to their capabilities to the company's own intentions.

4. Management in networks in a smart city context

So, smart city initiatives are on the rise, according to several scholars and based on some early implementations as outlined above (cf. Manville et al., 2014, Saint, 2014). But what would they mean for how companies manage in networks; and how will companies' interaction potentially change based on a radical societal change?

If returning to the 6C model as outlined in Ford et al. (2003), questions could be addressed as to whether companies would conform or confront; create or consolidate; and concede or coerce based on new societal-level initiatives. Various companies would certainly expect to act differently in these aspects, but would certain trends dominate, and what would decide the paths taken by various firms?

Looking first at the conforming or confronting, any major change would exert the need for relationships to change to higher degrees than during "stable" conditions. Hence, companies would search to develop, or potentially change, current relationships. Such confrontation would push for new ideas, while reactions among business partners may either strengthen such changes or work opposite to them. In this manner, the ways business and interactions are formed, along with their new foci will impact and reshape smart city initiatives. Hence, what actually results in terms of realised smart cities are the consequence of shaped interactions and solutions (Håkansson and Ford, 2002). This is all in line with how the context consists of other companies and how a company may influence such other parties, while itself being influenced by them (cf. Havila and Salmi, 2000). Present interaction expects to slow down the processes leading to new ways of interacting and taking on new ideas, hence, changes may be less radical and occur later than those visions described by city authorities and the like.

As for creating and consolidating, the smart city initiatives could expect to lead to the creation of new relationships and companies moving to take advantage of new positions in networks. This is also seen in the early examples of smart cities, where companies have taken on new tasks and moved to more sustainable solutions. Companies (and other organisations) will grasp opportunities related to creating and offering solutions in line with smart city objectives: smart economy, mobility, environment, people, living, and governance. This all would mean that sectors related to health, energy, water, waste, communications, buildings, and transport would attract new solutions, new actors, and new interactions. This also means that new actors will expect to enter into present structures, and how companies may shift sectorial belonging as radically new solutions are needed and potentially adopted from other sectors than the present one. Parallel to new sectors, solutions and businesses being formed, other ones will decrease in importance, or be out of business based on how the contrast fundamental principles of smart cities. Logistics firms expect to be less about transportation, and those focusing on long-distant transports may have difficulty to remain in the market, or opt for radical changes to what business they conduct and how they perform it. Here, smart city initiatives would either mean that companies move together with their interaction partners, or break new ground and hence disband from previous interaction partners to find new ones.

In the wider development of smart city initiatives (but not yet seen in practice), interaction among companies (and other organisations) would expectedly increasingly be determined by geographical location. Companies would work more with other firms geographically close to them so as to minimise environmental impact from transportations (cf. Bonilla, 2014). With this also follows less interaction on global levels and with firms geographically distant to the company. In turn, this prescribes a change to current interaction patterns. Companies currently

acting at a distant, may choose to change interaction partners, or co-locate their businesses, for instance. Furthermore, citizen engagement may foster such solutions as crowdsourcing, crowdfunding, and related (cf. Fleming and Waguespack, 2007, Ebner et al., 2009, Stieger et al., 2012), and thereby the net (cf. Möller and Rajala, 2007) would become an important network actor. Such nets may very well be flexible in time and members, but function as a unit as part of the network. Thus, actors may not only be companies, but more loosely coupled 'organisations' acting for a joint output, but possibly with differences in how parties participate, their incentives to do so, and so forth.

Coercing or conceding, lastly, would include how companies attempts to reposition themselves and thereby do so to reach new resources of others. Hence, and while smart city initiatives may intend to introduce new ideas and innovations (Herrschel, 2013), it may have more to do with how various resources are actually recombined. Resources and capabilities aimed for would include sustainability orientations of other firms. Table 1 summarises some of the ideas related to how interaction may change as the consequence of smart city initiatives.

[Please insert Table 1 about here]

Many of the ideas on smart cities that currently appear in media and discussions are quite far-reaching at present. Those initiatives that are implemented (Manville et al., 2014) indicate how city administrations play a decisive part (but doing so also to promote not presently out there), how sustainability issues have become the key concern and how most efforts are placed at energy sectors, and how technology functions more to develop sustainable solutions than, at present, at redirecting production to local manufacturing, or to engage citizens in the

city formations. The present practice of smart cities hence suggest how companies have repositioned to make their offerings more sustainable (or promote them as such), while the development of smart cities is not yet company or citizen driven. In the creation of sustainable solutions, partly new actors appear, and partly new relationships are established, but would also include how companies in their present relationships raise the awareness of sustainable solutions. So, while some signs are present on the development of smart cities, much is still based on future-oriented ideas rather than present practices. And, companies could suggest to be stuck in their present network structures to such extents that few of them really move to meet city-level initiatives.

5. Concluding discussion

This paper has discussed how companies would manage in a smart city context, while also being part of shaping it based on an IMP network approach and specifically with the focus on management in networks (Ford et al., 2003). The paper indicates how interaction among companies (and other organisations) would increasingly be determined by geographical location; how companies will grasp opportunities related to creating and offering solutions in line with smart city objectives; and how the ways business and interactions are formed, along with their new foci will impact and reshape smart city initiatives, if they follow those initiatives and ideas that are currently promoted. But while smart city initiatives provide such changes, outcomes follow from actions, reactions, and various parallel activities among companies. Three forces can hence be identified: companies that pursue activities to adjust to or implement change; reactions among other companies, along with their own activities that may reinforce or weaken initial activities; and smart city ideas and realisations based on how they may shape opportunities, require change, etc. that are taken on by companies, or opposed by them. These activities are all acted by organisations in the network, and present practices

of smart city initiatives (Manville et al., 2014) indicate more of how companies keep with present structures than confront, create, and coerce related to smart cities. It is only related to sustainability that companies have moved to build new positions, and potentially come to make use of capabilities related to sustainability in the network. But the slow development in turn suggests how networks create opposing forces to change, as also previously described in literature on radical innovation, for instance (e.g., Story et al., 2011)

So, while radical initiatives on societal levels would increasingly expect to lead to companies confronting, creating, and coercing in relation to business partners and the network (Ford et al., 2003), companies and their business relationships suggest to inhibit such "revolutionary" changes, and much is yet to be realised if ideas on smart cities are to become practiced by companies.

5.1 Further research

If smart city initiatives become realised, they constitute an interesting arena for studying business and interaction change. Such studies may, as discussed here, be based on an IMP network approach, but social network analyses and related create interesting lenses to grasp network changes, alliance formations, and what opportunities occur as the consequence of how companies start working with issues central to smart city initiatives.

This present paper is exploratory and conceptual, rather than empirically based. For further studies, real-life case examples of smart city initiatives could be collected. With many smart city initiatives either being at a planning or early-implementation stage, an alternative to capture such early initiatives, would be to perform historic data studies (cf. Ford and

Redwood, 2005) based on medieval cities, for instance, where local production, etc., would be expected.

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Table 1: Managing in networks in a smart city context

Managing in networks…	**Influenced by smart city initiatives**	**Influencing smart city initiatives**
Conform or confront	Businesses and interaction patterns are affected by smart city initiatives… Other parties' smart city activities affect the company	…. while also affecting the local understanding of smart cities and their functioning The realisation of smart cities follow from how various parties act on such ideas
Create or consolidate	Companies trying to pursue opportunities from smart cities (new solutions, new businesses). These may change businesses of others, but also in their outcome be affected by such other actors. Crowdsourcing etc.	Companies try to reinforce or oppose smart city initiatives, leading to possible delays or refocusing. Outcomes of joint activities may influence other players to also take steps towards forming smart city initiatives
Coerce or concede	Increased focus on sustainable or smart solutions and interaction partners acting in such related areas, while shifting away from companies whose business focus diverge from smart city ideas	The way companies choose and deselect business partners affect the realisation of smart city initiatives (and what meaning others give it)